Monitoring, Recordkeeping and Reporting

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Chapter 7. Monitoring, Recordkeeping and Reporting

A. Introduction

Monitoring requirements will be determined by the need to either meet the regulatory requirements specified by the Central Valley Regional Water Quality Control Board (RWQCB) or to assist the manager in the operation of the IFDM system. As a result, there will be significant differences in the types of data collected and the frequency of data collection.

Monitoring of irrigation water quality and depth of application, soil salinity, groundwater depth and quality, volume and quality of drainage flows, and the subsequent recordkeeping practices are essential components of a successful IFDM program. Water quality data are needed to identify changes or trends in water quality as the water moves through the IFDM system. Groundwater monitoring data is a required component of the Notice of Intent (NOI) application to be filed with the RWQCB prior to installing the solar evaporator. The groundwater monitoring data will be used to establish the baseline information to compare subsequent data submitted by the operator. While much of the emphasis in the monitoring program is on the need to meet the regulatory requirements, the data collected will be valuable to the operator for use in managing the IFDM system. Monitoring reports will help characterize the system operation and identify specific water quality problems. Data from these reports can be used to determine California Environmental Quality Act (CEQA) baseline data.

The soil and water data collected at the beginning of the monitoring program will describe the baseline condition of the land and water resources prior to implementing IFDM and will be the basis for the IFDM project design. These data will identify constituents that may affect the operation or that will require special consideration in the future. The designer will use these data to select the fields to be used for each production area of the IFDM system, and to design a management program to reclaim fields if necessary and ensure the long term sustainability of the project.

One of the most important outcomes will be to use the water quality data to determine whether project compliance and implementation goals are being met. A critical aspect will be for the operator to evaluate the management scheme and to project the long-term health of the system.

B. Data Quality

The quality of data collected is described by its accuracy, precision, completeness, representation and comparability. Multiple factors influence the data quality, including sampling methods, the way samples are handled and analyzed, and the way data are handled. To ensure high quality data the IFDM operator will have to develop a plan of action, generally called a quality assurance program plan. The RWQCB may require a Quality Assurance Program Plan (QAPP) for each IFDM project. Quality assurance (QA) includes measures that are performed to ensure that there is minimal error and that data are valid and reliable. The two measures of QA are quality control (QC) and quality assessment. A QAPP is an important planning document for environmental data collection because it details the project management, standard operating procedures (SOPs), QA (QC and quality assessment measures), and data assessment measures that will be implemented throughout the project. In general, California certified laboratories will have QAPP for the samples brought to the laboratories. If their personnel are used in the data collection, the potential for mishandling samples and improper sample collection will be reduced.

The California Environmental Protection Agency SWRCB Water Quality website, www.swrcb.ca.gov/swamp/qamp.html, (see Appendix page A-55) outlines the sections and appendices of a Surface Water Ambient Monitoring Program (SWAMP) QAPP. The California Department of Water Resources (1998) Guidelines for Preparing Quality Assurance Project Plans is a helpful reference for QAPP development and preparation.

The complete monitoring program will include groundwater, surface drainage, subsurface drainage, the solar evaporator and the soil status. All of these data are not necessary to meet the regulatory requirements, but they will be essential for the successful operation of the IFDM system.

C. Monitoring & Reporting Program

IFDM systems must be designed and operated to prevent threats to water quality, fish and wildlife, and public health. Monitoring and recordkeeping requirements, including a groundwater monitoring schedule, data, and any other information or reporting, will be specified by the RWQCB. A properly designed monitoring program will aid in assessing any impact of the IFDM system operation on surface and groundwater quality, and fish and wildlife.

1) Groundwater Monitoring

Groundwater monitoring will be required to manage the shallow groundwater at the IFDM site and to measure any impact of the system operation on groundwater quality. Additionally, a person operating a solar evaporator will be required to collect adequate groundwater data in the vicinity of the evaporator to monitor the operation of the evaporator. All indicator parameters and constituents of concern must be collected from monitoring wells installed by the operator. Groundwater monitoring includes measurements for water level depth, specific electrical conductivity, standard minerals, and trace elements as specified by the RWQCB. The data also may be used to evaluate potential off-site influences on the area.

2) Subsurface Agricultural Drainage

Water collected from the production area prior to application to the solar evaporator will need to be measured for volume and quality. Applied water monitoring will include mean daily flow measurements, specific electrical conductivity, standard minerals and trace elements as specified by the RWQCB.

Consideration also should be given to measuring the volume of water collected from the drains under each production area and the EC under each area. This will provide the information needed to best manage the system. The quality measurements for water collected under the production areas may be limited to EC and standard minerals that will impact the agriculture success, i.e. Na and B.

3) Solar Evaporator Subsurface Drainage

Construction of a solar evaporator may require the installation of a subsurface drainage system under the evaporator to collect any leakage from the evaporator (see Solar Evaporator Design Requirements (c) Protection of Groundwater Quality, Appendix page A-86). Solar evaporator subsurface drainage systems (tile drains) are monitored for mean daily flow and specific electrical conductivity as specified by the RWQCB. In addition, evaporite salt should be sampled and analyzed for composition to monitor accumulation of metals and other elements.

4) Sampling Plan

The sampling plan will be developed in response to the regulatory and management requirements for the operation of the IFDM system. This should be done in consultation with an approved laboratory. Sampling plans are written procedures that provide details on how sampling is conducted (SOPs) and are incorporated as part of the QAPP. A typical sampling plan should include details on the following, as appropriate:

- Sample locations (map or diagram)
- Sample type
- Sample frequency
- Number of samples
- Duration of sampling
- Sample volume
- Sample collection methods and holding times
- Equipment to be used for sample collection
- Sample containers
- Pretreatment of containers
- Type and amount of preservative to be used
- Blanks, duplicates/triplicates, spiked samples, replicates
- Chain of custody procedures
- Any other pertinent matter, which will have a bearing on the quality assurance in collecting and handling samples (DWR, 1994)

5) Who will perform the monitoring and how?

One of the critical details is selection of the responsible person for sample collection in accordance with the sampling plan. This person should be knowledgeable and trained in monitoring protocols, and should be selected to collect representative water samples, perform specific field measurements, and prepare samples for laboratory analyses using accepted methodology. This may be a representative of a laboratory contracted to complete the collection and analysis or someone employed by the IFDM operator. In the second instance, that person should receive training to ensure that sampling is done properly.

6) What parameters will be measured?

All indicator parameters and constituents of concern must be identified in the sampling plan by the operator and submitted to the RWQCB for approval. The baseline sampling data will provide information to determine the constituents of concern and constituents of importance. A typical sampling plan may include but not be limited to the following constituents:

a. Trace Elements
   - Selenium
   - Boron
   - Arsenic
   - Molybdenum

b. Standard Minerals
   - Calcium
   - Magnesium
   - Sodium
   - Potassium
   - Alkalinity
   - Sulfate

c. Specific Electrical Conductivity and pH

   Some water quality parameters must be measured in the field during sample collection for laboratory analysis. Field measurements are recorded for specific conductance, pH, air and water temperatures, and weather observations. Agricultural observations, such as, the type of crop and crop height are noted and submitted with the water samples to the analytical laboratory. Weather data can be found at the nearest station of DWR's California Irrigation Management Information System, (CIMIS), at: www.cimis.water.ca.gov.

d. Other

   Other elements of concern may be identified from the baseline monitoring data or as required by the RWQCB. Some elements are site-specific or found in elevated concentrations in designated areas of the San Joaquin Valley and these will have to be included in the sampling.

7) Approved Laboratories

The California Environmental Laboratory Improvement Act requires that an environmental laboratory producing analytical data for California regulatory agencies (including RWQCB) must be accredited through a Department of Health Services accreditation program for environmental health laboratories. The accredited labs also are known as certified through the Environmental Laboratory Accreditation Program (ELAP).

To select an ELAP certified laboratory in your area that can perform analyses on all required constituents, you must first identify the required Field of Testing (FOT)/ Field of Accreditation (FOA) numbers. The RWQCB will determine what constituents will be required and identify the corresponding FOT/FOA numbers.

- The following website shows a table of FOT/ FOA numbers, brief descriptions and levels of complexity. www.dhs.ca.gov/ps/ls/ELAP/pdf/FOT_Desc.pdf
- The following website shows a list of ELAP certified labs by county and name. To select a lab, look through the list of labs in your county and make sure that the lab that you select is accredited to perform analyses on all required FOT/FOA numbers. www.dhs.ca.gov/ps/ls/ELAP/html/lablist.htm

8) Where are the monitoring sites?

The sampling sites will be located to ensure that the data are representative of the operations of the IFDM system and the environmental aspects. Monitoring sites that are accessible, easy to find and reachable in bad weather will allow for measurements to be taken at the desired time. It will be necessary to assign a name and provide a description of each of the sampling locations and to develop a diagram with reference points on how to find the monitoring site. It might not be possible for all sampling sites to be continuously accessible. In this case, provisions need to be made for automated sampling.

9) Sampling frequency

Sampling frequency will be determined by the RWQCB. In general, sampling should be frequent enough to describe all important water quality changes or trends. Initially, more frequent monitoring may be needed to establish the baseline conditions. Once established, the frequency of monitoring may be reduced by the RWQCB according to the laboratory test results.

It is important to summarize the data to clearly illustrate compliance with all applicable regulatory requirements. Arrange the data in tabular form so the required information is readily discernible. Certain technical information must be submitted with the monitoring report. Daily evapotranspiration values of the nearest weather station from which information is available and copies of the laboratory analyses are to be submitted as part of the report. Weather data can be found at DWR's California Irrigation Management Information System, CIMIS, at: www.cimis.water.ca.gov

Any person operating a solar evaporator should submit annual groundwater monitoring data and information at the earliest possible time, according to a schedule established by the RWQCB. The regional board shall notify the operator of each solar evaporator of the applicable submission schedule.

D. Automated Systems for Data Collection

Significant technological achievements have made it possible to customize monitoring programs equipped with automated systems for data collection. This section will present the basic equipment for the design of automated systems to measure the volume of monitored discharge, water levels, and salinity measurements. The general concept is to select a datalogger and accessory equipment to measure sensor output signals, process the measurement over some time interval, and store the processed results. Using the datalogger support computer software, the user can access the datalogger unit with a pocket PC or laptop computer, download the data, analyze it for quality, and store the data in a database.

1) Manual vs. Instantaneous Readings

a. Benefits

Automated systems can provide various benefits to a monitoring program.

First, automated systems provide the capability to collect data in remote sites. Inclement weather may make it difficult, and sometimes impossible, to collect manual readings in a timely manner.

Secondly, precision measurements are a valued component in the monitoring plan. Instantaneous readings will allow for the increased number of readings and reduce the likelihood of reading or recording a "blunder" value. The output data will be analyzed to determine if any improvements in the IFDM system design or operational changes that benefit the management of an IFDM system are warranted. Also, the data will be used to determine whether or not the project is operating in compliance with permit conditions.

Lastly, automated systems can be used to meet QA/QC requirements.

b. Costs

Initially, the purchase of equipment for automated monitoring programs may appear costly. However, the potential exists to reduce costs in long-term monitoring programs by designing a monitoring program using equipment that can provide data quality with the following characteristics: reliable, continuous, and unattended. Automated systems will require additional expertise and cost for the operator that may not be warranted. This will be determined based on the extent and scope of the required sampling plan. All monitoring instruments and devices identified in the monitoring program must be installed, calibrated as necessary, and maintained to ensure continued accuracy and reliability of the devices. The maintenance and operation of automated systems requires skilled personnel that may not normally be part of a farming operation.

c. Weatherproof Enclosure

An enclosure houses the measurement and control module and power supply. Enclosures should have the following characteristics: fiberglass; water-tight; dust-tight, corrosion-resistant; and for outdoor use.

d. Programmable Datalogger

Dataloggers provide the capability for flexibility in data collection and analysis by providing the ability to collect data hourly, daily, or on longer intervals. The data maybe useful in water use efficiency analysis, such as, water conservation and water quality. The datalogger is programmed to read the parameter, such as temperature, at some specified time interval before it can make any measurements and then sends the reading to a storage location (a datalogger program must be created). The manufacturer's Operator's Manual will present a basic understanding of the datalogger operation and provide instructions for programming, data retrieval, installation, and maintenance.

e. Power Supply

A datalogger can be powered with sealed rechargeable batteries that can be float-charged by ac power or a solar panel. When using a solar panel light energy is converted to electricity or direct current with the output being controlled by a regulator that may be either a part of the panel or a separate device. The regulator functions to block any current flow from the battery to the regulator and limits the source current to the battery. The solar panel is oriented to receive maximum incident solar radiation.

f. Flow Measurement Device

Flowmeters are used for agricultural irrigation measurement applications, such as water management, sprinkler irrigation systems, and drip irrigation systems. Propeller flowmeters should comply with the applicable provisions of the American Water Works Association Standard No. C704-91 for propeller type flowmeters.

g. Electrical Conductivity Probe

An electrical conductivity probe or sensor can be used to measure the electrical conductivity (EC) of water in pipelines and open ditches. These probes can measure conductivity over a wide range of values. The appropriate range will have to be established as part of the initial investigations. A conductivity interface is required.

h. Pressure Transducer

The depth to groundwater is measured using a pressure transducer, which is a device that converts pressure into an analog electrical signal. Although there are various types of pressure transducers, one of the most common is the strain-gage base transducer. Several manufacturers have developed inexpensive devices for continuous measurement of groundwater depths. These devices store the data for intermittent downloads. Groundwater level data combined with the irrigation data will provide information on the quality of irrigation system management. It will enable the manager to characterize the deep percolation losses under each system by characterizing the water table response to irrigation.